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ORIGINAL ARTICLE

The role of the retrograde colonic enema in children with spina bifida: is it inferior to the antegrade continence enema?

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Abstract
Objectives The aim of this study was to evaluate the efficacy of the retrograde colonic enema relative to the Malone antegrade continence enema.
Methods We retrospectively investigated 25 children with spina bifida and fecal incontinence. Thirteen children had started retrograde colonic enema and twelve had started Malone antegrade continence enema. Fecal continence, water volume, time to washout, procedure frequency, pain during procedure, performance independence and demographical data were compared between the two groups.
Results Fecal continence was achieved for 10 of 13 (76.9%) in the retrograde group and 9 of 12 (75.0%) in the antegrade group. In the antegrade group 8 of 12 (66.7%) performed procedure independently, while 3 of 13 (23.1%) did so in the retrograde group. Achievement of fecal continence did not differ between the groups, but procedure independence was significantly better in the antegrade group.
Conclusions Our results suggest that retrograde colonic enema was not inferior to Malone antegrade continence enema on fecal continence. We recommend considering retrograde colonic enema prior to introduction of Malone antegrade continence enema in children with spina bifida.

Keywords Enema · Fecal incontinence · Spinal dysraphism

Abbreviations

MACE	Marone antegrade continence enema
RCE	Retrograde colonic enema
LACE	Left colonic antegrade continence enema

Introduction

Spina bifida is a congenital defect of the neural tube and lower spinal cord with varying degrees of neural symptoms that can include neurogenic bladder and rectal disorder. Appropriate management is often successful in achieving urinary continence, but fecal incontinence remains a major problem for children with spina bifida. The fecal status also has a major influence on quality of life [1–3].

Since its introduction by Malone et al. [4] the MACE procedure has been accepted as one of the most useful techniques for resolving fecal incontinence in children with spina bifida. However, the downside of this procedure is the necessity for surgery. Given this drawback, the mainstay of conservative treatment remains the RCE.

Recently, many pediatric urologists have recommended the MACE procedure because of its high resolution rate for fecal incontinence [3, 5–9]. However, too few investigations have been completed to ensure the advantages of MACE over RCE in terms of outcomes. In this study, we compared the efficacies of the RCE and MACE procedures to evaluate RCE.

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Methods

The study was performed with the institutional review board's approval. We retrospectively reviewed the medical records and interviews of children with spina bifida who had experienced fecal incontinence and who had begun RCE or MACE in our department from March 2004 to 2007. Parents were interviewed if the children were not old enough to answer.

In our institution, systematic approach to fecal incontinence in children with spina bifida was started in 2003. We basically recommended the RCE procedure for children with fecal incontinence which had not been improved with laxatives, glycerin enemas, or digital disimpaction. On the other hand, MACE procedure was primarily recommended in children who needed bladder reconstruction and vigorous bowel therapy due to intractable urinary tract problems and fecal incontinence. All children who underwent MACE procedure did not have any history of RCE procedure except one boy.

The children who had been using each enema procedure for <3 months and dropouts were excluded from the study, leaving 25 children who matched inclusion criteria. Of these, 13 patients had started RCE and 12 patients had started MACE. All children in MACE group had undergone in situ appendix technique [10], and all except one had undergone the MACE operation concomitantly with bladder augmentation. In cases with bladder augmentation, we use only ileum for augmentation, and there were no children with colon resection. For the management of bladder emptying, all children in this study used clean intermittent catheterization.

For irrigation in both groups, only tap water at 37–40°C was used. At the initiation of either RCE or MACE, patients performed the enema procedure daily. After they achieved facility with the procedure, these intervals gradually increased. Although we typically recommend an enema procedure every 2 days, children and their parents adjusted the intervals based on changes in the child's physical condition and the results of defecation. Regardless of whether irrigation was performed, they placed a catheter in the stoma daily to prevent stenosis.

To evaluate and compare the efficacy of the procedures, we investigated the demographical data (age, gender, primary disease, ambulatory ability) and following six factors: fecal continence, water volume to perform washout, time to perform washout, frequency of procedure, abdominal pain during procedure, and independence with procedure.

We defined "fecal continence" as the condition without any soiling and "Abdominal pain during procedure" as the pain occurred between start of irrigation and completion of stooling. "Independence with procedure" indicated that patients were able to complete all techniques of the respective enema procedure, including preparation of tools for irrigation.

Mann–Whitney's U test, Fisher's exact test and χ^2 test were used for statistical evaluation. StatView for Windows Ver. 5.0 (SAS Institute Inc.) was used for statistical calculation.

Results

The RCE group had three boys and ten girls, and the MACE group had nine boys and three girls. Demographic data of children in both RCE and MACE group are described in Tables 1 and 2.

Average age at entrance into the program was 7.9 ± 6.1 years (range 4.5–15.2 years) in RCE group and 13.8 ± 11.4 years (range 4.1–23.1 years) in MACE group.

Table 1 The demographic data of children in RCE group

Case no	Age at introduction (years)	Following period (months)	Gender	Primary disease	Ambulatory
1	11.1	30.3	F	Open myelomeningocele	Wheelchair
2	4.5	9.5	F	Open myelomeningocele	Ambulatory
3	5.5	12.7	F	Open myelomeningocele	Ambulatory
4	4.8	33.7	F	Open myelomeningocele	Brace
5	9.1	7.3	F	Open myelomeningocele	Brace
6	10.0	30.4	F	Open myelomeningocele	Brace
7	9.2	64.2	F	Open myelomeningocele	Brace
8	5.0	14.6	F	Spinal lipoma	Ambulatory
9	7.6	23.9	F	Spinal lipoma	Ambulatory
10	15.2	4.4	F	Spinal lipoma	Brace
11	7.0	26.3	M	Closed myelomeningocele	Ambulatory
12	6.2	44.0	M	Open myelomeningocele	Ambulatory
13	7.1	4.6	M	Open myelomeningocele	Brace

Table 2 The demographic data of children in MACE group

Case no.	Age at introduction (years)	Following period (months)	Gender	Primary disease	Ambulatory
14	6.6	16.0	F	Open myelomeningocele	Wheelchair
15	12.7	40.4	F	Open myelomeningocele	Brace
16	16.7	41.8	F	Open myelomeningocele	Brace
17	10.1	21.5	M	Lipomyelomeningocele	Wheelchair
18	17.1	22.6	M	Open myelomeningocele	Wheelchair
19	19.8	37.4	M	Open myelomeningocele	Wheelchair
20	8.2	18.6	M	Open myelomeningocele	Ambulatory
21	23.1	21.5	M	Open myelomeningocele	Ambulatory
22	18.1	29.8	M	Open myelomeningocele	Ambulatory
23	15.6	39.3	M	Open myelomeningocele	Ambulatory
24	14.0	47.5	M	Open myelomeningocele	Ambulatory
25	4.1	42.5	M	Spinal lipoma	Ambulatory

Table 3 Results of investigation of RCE and MACE group in seven parameters

	RCE	MACE	*P*
Fecal continence	10/13 (76.9%)	9/12 (75.0%)	>0.99
Water volume (ml)	565 ± 665 (300–1,500)	808 ± 612 (400–1,500)	0.026
Time to perform washout (min)	37.7 ± 28.8 (20–60)	36.7 ± 23.1 (20–60)	0.93
Procedure frequency (times per week)	3.9 ± 4.6 (1–7)	4.2 ± 4.0 (1–7)	0.54
Pain during procedure	5/13 (38.5%)	6/12 (50.0%)	0.85
Independence of performance	3/13 (23.1%)	8/12 (66.7%)	0.047

The children in the RCE group started the enema procedure significantly earlier than the children in the MACE group ($P = 0.009$). The mean follow-up periods in the RCE and MACE groups were 23.5 ± 34.9 months (range 4.4–64.2 months) and 31.6 ± 22.1 months (range 16.0–47.5 months), respectively. The groups were not significantly different ($P = 0.142$).

About the ambulatory status, wheelchair-bound children were 1 in RCE group and 4 in MACE group. Ambulatory children in RCE and MACE group were 12 and 8, respectively and both had brace user. However, there was no significant difference between two groups in ambulatory status ($P = 0.64$).

As for the six parameters, we investigated, the significant difference between MACE and RCE group were the required water volume to washout and independence of performance (Table 3): children in RCE group irrigated lower volume (565 ± 665 ml; range 300–1,500 ml) of tap water than MACE children (808 ± 612 ml; range 400–1,500 ml) ($P = 0.0264$). In the antegrade group, 8 of 12 (66.7%) performed procedure independently, while 3 of 13 (23.1%) did so in the retrograde group. The independence of procedure was significantly higher in MACE group ($P = 0.0472$). In the RCE group, 10 of 13 (76.9%) children achieved fecal continence, and 9 of 12 (75.0%) did so in the MACE group; this difference was not significant.

Discussion

The aim of both the RCE and MACE procedures is fecal continence. On this point, our study reveals that RCE is not inferior to MACE. However, our study showed relatively low continence rates with either procedure when compared with previous reports (Table 4) [6–9, 11, 12].

One possible factor influencing the success rate is irrigation materials. In our series, patients irrigated the colon with tap water only. However, many previous reports used saline only, saline and additives, or tap water with additives [3, 5, 6, 8, 12]. Some of these studies also used oral laxatives with colonic irrigation [3]. The additives in irrigation materials were salt, phosphate, mineral oil, or MiraLAX® [3, 5, 8]. Bani-Hani et al. [8] reported that results with the MACE procedure had improved after a change in irrigating material from tap water only to tap water with additives. Thus, a question that requires further investigation is

Table 4 Reports of RCE and MACE on the point of fecal continence: the percentages are the proportion of the patients who achieved complete fecal continence

	RCE (%)	MACE (%)
Schöller-Gyüre et al. [11]	66	–
Hensle et al. [6]	–	70
Eire et al. [12]	97	–
Curry et al. [7]	–	63
Vande Velde et al. [9]	88	60
Bani-Hani et al. [8]	–	83 (tap water only) 94 (with additives)
Present study	77	75

Table 5 Reports of RCE and MACE on the point of performance independence: the percentages are the proportion of the patients who perform each enema procedure independently

	RCE (%)	MACE (%)
Hensle et al. [6]	–	67
Eire et al. [12]	6	–
Vande Velde et al. [9]	13	63
Present study	23	67

whether using saline, additives, or oral medications improves results with RCE.

The required irrigation volume in the RCE group was smaller than in the MACE group. In this study, all MACE conduits were made on the right-side colon, which may have resulted in the difference in required water volume between the two procedures. The washout volume and transit time of RCE in our results were close to the values reported by Kim et al. [13] for left colonic antegrade continence enema (LACE). In their study, mean washout volume and transit time were 600 ml and 30 min, respectively. On the other hand, Meyer et al. [14] reported a solution volume and time required in both the left and right colonic antegrade enema, and there was no statistical difference between two procedures on the point of required water volume and transit time. In the current study, there was no statistical difference in washout volume or transit time between the two enema groups. A prospective investigation of RCE in the context of left and right colonic enemas should be done to clarify any differences.

Regarding performance independence, our results clarified MACE have higher chance to perform procedure independently than RCE. Previous studies have reported that independence ratio is much higher in MACE group than RCE group in patients with spina bifida [6, 9, 12] (Table 5). These previous results on the independence ratio of MACE are very similar to ours, but our results on RCE are slightly better than previous reports. Our relatively high success rate for independence may result from the early introduction of the RCE procedure and a support program in our outpatient clinic for fecal excretion with nursing specialists. In the previous reports, the mean ages when patients started the enemas were 11–13 years in RCE and 13–16 years in MACE [6, 9, 12]. In our department, we recommend the RCE procedure to parents of children with spina bifida at the age of 4–6 years if other methods (laxatives, glycerin enemas, or digital disimpaction) have failed. These children initially practice the enema procedure with their parents, and in their teenage years, when they want their parents to be independent of the enema procedure, they start performing the procedure on their own with advice from their parents and nursing specialists. This support is common for both the RCE and MACE procedures. We think a supervised training program is essential for increasing the independence ratio and decreasing the dropout ratio in both RCE and MACE.

The limitations of this study were that it was a retrospective chart review, with a relatively small number of children as compared to other reports, the age deviation of two groups, and that we did not randomly allocate children into two groups. These factors had large influences on each result. However, because there were few reports about comparison of RCE and MACE, our study may help in the decision-making which procedure is appropriate for each child with spina bifida for physicians and patients' parents. We recommend RCE for younger children with spina bifida because RCE has same chance to achieve fecal continence and because it does not require surgery. As the children reach the teenage years, when they can carry out the enema procedure by themselves, we present MACE as an option for its availability of independence and give them a choice. MACE procedure may be suitable for children who cannot carry out RCE procedure on their own in their teenage. For the best choice, we must provide enough information about each enema procedure regarding efficacy, execution method, required time, frequency, abdominal pain, and independence for children and their families.

In our study, RCE was not inferior to MACE procedure in terms of fecal continence achievement. However, MACE has some advantage about independence performing the procedure. We recommend RCE prior to introduction of MACE in the children with spina bifida and their teenage, when they want to become independent on fecal control and we present MACE procedure as an option.

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